DOINGWHATWORKS

Video
FULL DETAILS AND TRANSCRIPT

Preparation for Algebra

Worthington Hooker School, Connecticut • June 2008

Topic: National Math Panel: Critical Foundations for Algebra
Practice: Mathematics Preparation for Algebra

Highlights

- Math teacher describes the pre-algebra lesson: taking a word problem, putting it into a table, and translating into graph, moving a real-world problem into a numeric representation
- What it takes to be good in number sense: solid foundation in fractions, decimals, percents; ability to work with positive and negative integers; multiple ways to tackle open ended problems
- The most important pre-algebra year topics: fractions; ratios and proportions; geometry; statistics and probability
- Moving from concrete to abstract through practice, connections across problems, and showing problems in many different ways
- Example of moving from a table to graphs
- Student readiness for algebra is based on: ability to manipulate numbers in an equation; perform operations with integers; interpret a graph
- Goal of taking a real world problem, making a table or graph, and then writing an equation

About the Site

Worthington Hooker School
New Haven, CT

Demographics
45% White
25% Black
22% Asian
7% Hispanic
37% Free or Reduced-Price Lunch
11% English Language Learners
6% Special Education

The Worthington Hooker mathematics program exemplifies the goals of the New Haven School District in holding high expectations for all students, and preparing them for STEM career options. The school implements these features:

- Focus on fewer topics at deeper level of understanding,
- Cross-grade units with " significant tasks,"
- Benchmark testing four to seven times a year,
- Extensive focus on number sense and fractions,
- Roles for specialist teachers (i.e., physical education, music, visual arts) in providing additional math practice,
- Bi-monthly school level data team meetings, and
- Monthly coaches meetings at a district level to review results of school-level data team meetings.

Full Transcript

I am Beth Klingher. I teach 7th and 8th grade math, here at Worthington Hooker School in New Haven, Connecticut.

The lesson was a pre-algebra lesson. It involved making a table of data, and then transferring that data into a graph. It was a word problem involving a race between two children. The goal here was really to have the kids take a real-life situation and be able to take that information and put it into a numeric representation, which was a graph. Many children could have approached the lesson in many ways. It involved, actually, building on some of the algebra skills we have been using for the past week or so -- which is actually taking ordered pairs and graphing them on a coordinate grid. So that actually gave them the preparation for, then, taking this data from their table and building a graph of it. After they build the graph, there is a secondary

step, of looking at the graph and seeing how does this graph actually relate to the word problem, what do the lines mean? One line represented one child in the race, another line represented another child in the race, and actually looking at the intersection point and understanding that that intersection point represented where one child overtook the other in the race. So it was really trying to get a real-world example that was graphed—how that graph really represented something occurring in the real world.

In order to really be strong in algebra, you need a few things: You need good number sense. Number sense is an understanding how numbers work -- the factors, the multiplication facts, the interrelation between numbers, and that includes a number of things: One is having a good understanding of fractions, decimals, and percents; that's a solid foundation that's really required. I think the second thing is a good understanding of positive and negative integers; that's something a lot of kids struggle with and it's something we try to really reinforce in pre-algebra. And, the third thing is being able to really tackle open-ended problems. I am a big proponent of open-ended word problems, problem-solving skills. One of the things I really work with my students on is learning how to attack an open-ended problem, and to be able to productively struggle with that problem. It's not obvious, at first, what the answer is; but, they can use all of the number sense skills that they have to attack that problem, and trying to encourage them to get over their initial frustration in handling a problem, and to persevere and to work through the problem. I think, although that's not specifically number sense, it's a very important skill—especially when they get into algebra—a skill that I try to work on quite a lot in pre-algebra.

During our pre-algebra year, and we start off the year going through a whole section on basically what we call number sense—but it's fractions, decimals, and percents. We then move on to proportions and ratios. All of those things are important and key elements moving on to algebra. We also do a unit on both geometry, statistics and probability—which all feed-in to the pre-algebra curriculum. You really need all of those things, pulled together, to integrate for algebra.

I use visual representations quite a lot. Now, whenever we do solve a problem, I usually do some kind of drawing to start out. It's also a great way to loosen up the kids. If somebody looks at a problem and they are frustrated, they don't know where to begin, I always say, "Draw a picture of what's going on; get something down on paper that gets you moving," and that's a great way to start working. It's also a great way to solve many problems because a picture really helps you orient things, whether it's something broken up into parts or something… As an example, today's lesson we had a race. Well, you can actually show the race, at different points in time with a picture; and I noticed some kids were actually drawing little stick figures of people—where they started and where they were—at different points on a race, and that really helps you visualize what's going on; and it very often can get many students—who may have little blocks against things—get them moving and understanding how a problem could be solved.

It's difficult to get students to move from the concrete to the more abstract. I think one of the ways you can help is a lot of practice because the more practice you have with the concepts, the more you can start to understand how one concept is connected to another; or one problem is connected to another and you

start understanding kind of a bigger picture view of it. The other way, I think, is to show problems in many different ways—visually, with manipulatives, with numbers—and all of a sudden instead of it just being an equation, you can see how the conceptual or the concept can pull it together. For example, today's lesson they had a table so they can look concretely at where the racers were, at each point in time, and that concrete table is then brought into the visual graphic, which is a little less concrete. I mean, it is concrete for those who understand graphs; but, for those who are trying to understand what a linear equation is, or what the line represents, it moves them a little further along on that spectrum from concrete to abstract—an ability to graph or see things visually on a graph to understand what the coordinate plane is, and how that tells a story.

It's often difficult to tell when students have mastered the requisite skills for algebra. The main thing, I look for, is the ability to manipulate numbers in an equation; the ability to add, subtract, multiply, and divide positive and negative integers; and the ability to interpret a graph. One of the additional challenges I gave the students this morning, in the lesson, was to take the information that they had gleaned from the problem, the table, and the graph; and then move to the next step, which is writing a linear equation. Now, we haven't spent a lot of time on equations this year, but a lot of them are ready for taking that next step, that more conceptual step. So, that was a challenge we gave them today to push them a little more towards the conceptual realm.

The lesson, today, was really the first time the students were taking some real-world examples and applying some of their algebra skills to those real-world examples. We do it throughout the year with word problems, but this is the first time we really graphed a real-world problem. So, my hope is that by the end of the year, the students will have a solid understanding about how to take a problem—a situation—and not only to make a table and graph but then to write an equation based on that problem. Now, next year they will all be going into algebra; and we will, of course, reinforce that again; but, they will start off the year with a pretty solid understanding of what a linear equation means—it's not just a bunch of numbers and operations, it actually can represent something going on in the world.